WellCAP®
IADC WELL CONTROL ACCREDITATION PROGRAM

UNDERBALANCED OPERATIONS
CORE CURRICULUM AND RELATED JOB SKILLS

FORM WCT-2UBS
SUPERVISORY LEVEL

NOTE: It is suggested that the course be taught in the order presented here.

The purpose of the core curriculum is to identify a body of knowledge and a set of job skills, which can be used to provide well control skills for underbalanced drilling operations.

The suggested target students for each core curriculum level are as follows:

SUPERVISORY: Assistant Driller, Driller, Toolpusher, Superintendent, Onsite Drilling Consultant, and Underbalanced Equipment Supervisor.

Upon completion of an underbalanced drilling well control training course based on curriculum guidelines, the student should be able to perform the job skills in italics identified by a "■" mark (e.g., ■ Perform bottom hole pressure calculations).

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I. SIMILARITIES AND CONTRASTS BETWEEN CONVENTIONAL DRILLING AND UNDERBALANCED DRILLING

TRAINING TOPICS	*JOB SKILLS*
A. Definitions of conventional and underbalanced drilling	■ *Define conventional drilling and Underbalanced Drilling*
B. Similarities 1. BOP stack 2. Control of well at all times 3. Health, Safety & Environmental Issues	■ *Identify similarities between conventional drilling and Underbalanced Drilling*
C. Differences 1. Primary barrier changed 2. Well control identification 3. Hydrocarbons are not always expected at the surface	■ *Identify differences between conventional drilling and Underbalanced Drilling*

II. UNDERBALANCED DRILLING OVERVIEW

TRAINING TOPICS	*JOB SKILLS*
A. Case studies 1. Case Study 1 – High Energy 2. Case Study 2 – Depleted Reservoir 3. Case Study 3 – Hydrogen Sulfide	■ *Describe common features of Underbalanced Drilling case studies*
B. IADC classifications 1. Low pressure applications, high-pressure applications	■ *Describe IADC classifications and significance*
C. HS&E 1. Redundant barrier	

III. UNDERBALANCED DRILLING TECHNIQUES

TRAINING TOPICS	*JOB SKILLS*
A. Air and natural gas drilling **B. Mist drilling** **C. Foam drilling** **D. Aerated fluid drilling** **E. Flow drilling (gas flaring & onsite oil storage)** **F. Mud cap drilling** **G. Snub drilling** **H. Production drilling (PD)** **I. Liquid drilling**	■ *Demonstrate understanding of each Underbalanced Drilling technique* ■ *Explain what conditions influence the type of Underbalanced Drilling technique selected for a specific well* ■ *Compare the advantages and disadvantages of each Underbalanced Drilling technique* ■ *Explain importance of cross-functional teamwork and integrating drilling and production operations*

IV. DOWNHOLE CALCULATIONS FOR UNDERBALANCED DRILLING TECHNIQUES

TRAINING TOPICS	*JOB SKILLS*
A. Dynamic (equivalent circulating densityment circulating density) vs. static (hydrostatic)	■ *Compare Dynamic vs. Static*
B. Manual – kill fluid calculations (conventional)	■ *Explain difference between kill weight fluid and balanced weight fluid*
C. Multi-phase flow modeling	■ *Demonstrate understanding of purpose and use of flow model* ■ *Complete IADC Underbalanced Operations Daily Report*

V. DETECTING SURFACE CONTROL PROBLEMS

TRAINING TOPICS	*JOB SKILLS*
A. Fluid volumes at surface	■ *Explain importance of recognizing differential flow*
B. Pressure	■ *Review existing pressure detection technology* ■ *Demonstrate ability to recognize surface limitations*
C. Determining need for conventional well control	■ *Explain limits of underbalanced operations*
D. Elastomer considerations/flow path	■ *Explain need for specialized elastomers*

VI. UNDERBALANCED DRILLING EQUIPMENT AND RIG UP

TRAINING TOPICS	*JOB SKILLS*
A. Rotating diverter control head	■ *Explain the rotating diverter control head function*
B. Separation equipment 1. Texas atmospheric system 2. Closed pressured system	■ *Identify two types of separation equipment* ■ *Explain the conditions for using either type of separation equipment*
C. Flare line sizing and hook up	■ *Understand nomogram sizing*
D. Flare line igniters	■ *Explain different types of flare igniters*
E. Flame arresters	■ *Explain different types of flame arresters*
F. Kill line hook ups	■ *Understand applications of kill line hookups*
G. Choke manifold hook ups	■ *Recognize need for redundant hook ups*
H. Stripping manifolds and methods	■ *Explain safe stripping methods*
I. Choke considerations	■ *Understand different choke types*
J. Drillstring floats	■ *Understand different types and locations of drillstring floats*
K. BOP stack configurations	■ *Explain advantages and disadvantages of various BOP stack configurations* ■ *Demonstrate understanding of UBO testing of BOP stacks*
L. Fluid transfer systems and level maintenance	■ *General understanding of fluid transfer systems and operation*
M. Onsite fluid storage systems	■ *General understanding of onsite fluid storage systems*
N. Emergency well control equipment	■ *Explain purpose of kill pump and extra equipment*
O. Standpipe manifold	■ *Explain standpipe manifold requirements*

TRAINING TOPICS	*JOB SKILLS*
P. Gas vs liquid injections	■ *Understand standpipe manifold operations* ■ *Explain differences between gas and liquid injections*
Q. Compromise on conventional Pit Volume Totalizer (PVT) system	■ *Explain PVT limitations for underbalanced operations*
R. Coil tubing	■ *General understanding of coil tubing*
S. Snubbing	■ *General understanding of snubbing*
T. Deployment valves	■ *General understanding of deployment valves*

VII. ACCUMULATOR TESTING AND MAINTENANCE

TRAINING TOPICS	*JOB SKILLS*
A. Scheduled maintenance	■ *Understand need for scheduled maintenance*
B. Scheduled testing	■ *Demonstrate how to perform accumulator test*
C. Written testing/maintenance report 1. Weekly 2. With Daily Drilling Report	■ *Understanding the need for scheduled testing and inspection*
D. Special considerations	■ *Clear understanding of potential problems and safety hazards*

VIII. SURFACE EQUIPMENT TESTING AND MAINTENANCE

TRAINING TOPICS	*JOB SKILLS*
A. Trapped pressure issues	■ *Understand general opening/closing procedures* ■ *Explain opening and closing sequences*
B. Gas vs liquid BOP stack tests	■ *Explain inefficiencies of testing stack with gas* ■ *Recognize importance of using liquid in stack tests*

IX. BOTTOMHOLE PRESSURE CONTROL

TRAINING TOPICS	*JOB SKILLS*
A. Underbalanced margin	■ *Understand significance and how underbalanced margin is determined.* ■ *Recognize significance of change in underbalanced margin*
B. Choke control and surface pressure	■ *Understand the effects on bottom hole pressure (BHP)*
C. Hydrostatic versus friction dominated flow	■ *Understand the effects on bottom hole pressure (BHP)*
D. Surface pressure limitations 1. Surface equipment 2. Derated casing or tubing 3. Open formations	■ *Understand and recognize weakest link*

X. MAKING TRIPS, COMPLETIONS, LOGGING AND CONNECTIONS

TRAINING TOPICS	*JOB SKILLS*
A. Tripping in hole	■ *Understand procedures & practices*
B. Tripping out of hole	■ *Understand procedures & practices*
C. Making a connection	■ *Understand procedures & practices*
D. BHA deployment	■ *Understand placement*

XI. PIPE "LIGHT" CALCULATIONS AND OPERATIONS

TRAINING TOPICS	*JOB SKILLS*
A. Calculations	■ *Demonstrate ability to perform pipe "light" calculations*
B. Operations	■ *Understand equipment and techniques*

XII. COMPLICATIONS WHILE DRILLING UNDERBALANCED (Supervisory Level Only)

TRAINING TOPICS	*JOB SKILLS*
A. Excessive surface pressures and high pressure pumping consideration	■ *Understand a plan of action*
B. Leak in pressure control equipment	■ *Understand a plan of action*
C. Loss of pumping capability	■ *Understand a plan of action*
D. Plugged bit	■ *Understand a plan of action*
E. Cut out choke or manifold or plugged choke	■ *Understand a plan of action*
F. Loss of ability to circulate	■ *Understand a plan of action*
G. Bit nozzle washout	■ *Understand a plan of action*
H. Casing or cement failure	■ *Understand a plan of action*
I. Drill pipe or coil washout	■ *Understand a plan of action*
J. Parted drill pipe/coil	■ *Understand a plan of action*
K. Open hole loss of circulation	■ *Understand a plan of action*
L. Formation influx	■ *Understand a plan of action*
M. Leaking float valves	■ *Understand a plan of action*
N. Gas leak from BOPs to accumulator	■ *Understand a plan of action*
O. Critical escalating problems 1. Stuck pipe 2. Ruptured kelly hose 3. Failed flowline	■ *Understand a plan of action*
P. Injection line leaks	■ *Understand a plan of action*
Q. Hole cleaning	■ *Understand a plan of action*
R. Hole stability/collapse	■ *Understand a plan of action*

TRAINING TOPICS	*JOB SKILLS*
S. Corrosion	■ *Understand a plan of action*
T. Down hole fire	■ *Understand a plan of action*
U. Foam stability	■ *Understand a plan of action*
V. Flash points	■ *Understand a plan of action*
W. Hydrogen sulfide kick	■ *Understand a plan of action*

XIII. IADC UNDERBALANCED DRILLING TOUR REPORT

TRAINING TOPICS	*JOB SKILLS*
A. Purpose and importance	■ *Understand the importance of complete data*

XIV. SITE MANAGEMENT ISSUES

TRAINING TOPICS	*JOB SKILLS*
A. Safe explosion radius for equipment	■ *Demonstrate understanding of explosion radius for equipment*
B. Crew training	■ *Identify minimal training required for drilling crew*

XV. SIMULATOR TRAINING

TRAINING TOPICS	*JOB SKILLS*
A. Drilling fluid design	■ *Develop thought processes* ■ *Pass hands-on performance evaluation*
B. Multi-phase flow characteristics	■ *Develop thought processes* ■ *Pass hands-on performance evaluation*
C. Problem detection and response	■ *Develop thought processes* ■ *Pass hands-on performance evaluation*